# A Legislative Approach to Control Migratory Bird Populations to Ensure Water and Food Safety

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## Abstract

The impact that migratory waterfowl droppings have on water quality and food safety endangers human health, primarily in the risk of pathogen infections. Current policies on bird population and migratory range stem primarily from the United States' federal legislation in the *Migratory Bird Treaty Act of 1918* [(1)]. Controlling or limiting the populations of migratory waterfowl, including species who pose a risk to human health, is illegal within the bounds of federal legislation but change can be implemented by amendments to federal policies and a shift from federal to state jurisdiction[(3)]. By studying research on migratory species, weighing heavy international perspectives, policies, and regulations, a process to transition towards an adaptable strategy to protect human health in the form of new and amended legislation will protect against the threat that migratory waterfowl pose to water bodies and agricultural fields.

## Introduction

Geese fecal samples were collected at a research site in Southern Minnesota. Pathogens were detected in geese fecal samples by microfluidic quantitative PCR (MFQPCR) method[(9)]. Common pathogens that were found in high quantities in geese fecal samples were:

- *Escherichia Coli*
- *Campylobacter Coli*
- *Campylobacter jejuni*
- *Clostridium perfringens*
- *Legionella pneumophila* [Fig. 1].

Culture-based methods were also used to detect the frequency of *Campylobacter* species in the fecal samples. Out of 538 total samples, 49 samples (9%) tested positive for Campylobacter.

The international conventions implemented by the United States and Canadian's *Migratory Bird Treaty Act of 1918* offer special protection to migratory waterfowl. The United States and Mexico's 1936 amendment provided the *Protection of Migratory Birds and Game Mammals*[(2)]. Additionally, the *Endangered Species Act of 1973* encompasses all endangered species and prohibits their hunting and sale [(11)]. The act was signed by the United States to provide legislation to carry out the provisions in *The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)*[(12)].
In addition to the *Migratory Bird Treaty Act of 1918*, the *Lacey Act of 1981*, *Weeks-McLean Law*, the *Fish and Wildlife Conservation Act*, the *Wild Bird Conservation Act*, and the *Waterfowl Depredations Prevention Act* all protect migratory waterfowl[(11)]. Bird population and potential overabundance are the biggest driver in the quantity of pathogens that are found in both water and soil resources.

Target Genes (log copies/µl DNA)

| Sample | ftsZ | uidA | eaeA | stx1 | stx2 | ENT | hlyA | iap | ipaH7.8 | ipaH all | virA | invA | ttrC | cadF | ciaB | Clari | cpe | Cperf | mip | ctxA | toxR | tdh | IAC | NH8B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G012916_12 | 5.65 | 5.20 | | | | 4.13 | | | | | | | | | 1.96 | | | 3.29 | 1.50 | | | | | |
| G012916_17 | 1.57 | 3.94 | | | | 5.24 | | | | | | | | | | | | 5.30 | | | | | | |
| G012916_18 | 3.44 | 4.65 | | | | 3.98 | | | | | | | | | | | | 5.68 | 1.57 | | | | | |
| G012916_19 | 3.73 | 4.34 | 1.33 | | | 3.83 | | | | | | | | 4.49 | 5.66 | | | 2.77 | 1.24 | | | 0.55 | | |
| G012916_21 | 1.53 | 4.33 | | | | 3.37 | | | | | | | | 1.74 | | | | 2.08 | 1.56 | | | | | |
| G012916_28 | | 4.20 | | | | 3.90 | | | | | | | | 1.56 | 1.77 | | | 1.49 | 1.46 | | | | | |
| G012916_36 | 3.88 | 5.89 | | | | 4.21 | | | | | | | | 2.30 | 2.77 | | | | 0.93 | | | | | |
| G012916_48 | | 4.41 | | | | | | | | | | | | 1.45 | 2.17 | | | 1.48 | 1.27 | | | 0.23 | | |
| G022616_10 | | 4.37 | | | | 2.75 | | | | | | | | | | | | 1.76 | 2.06 | | | 0.44 | | |
| G022616_28 | | 4.15 | | | | 2.48 | | | | | | | | | | | | | 1.23 | | | | | |
| G022616_29 | | 4.29 | | | | 2.12 | | | | | | | | | | | | | 1.77 | | | | | |
| G022616_3 | 1.74 | 4.23 | | | | 3.36 | | | | | | | | | | | | 1.89 | 1.60 | | | 0.23 | | |
| G022616_32 | | 4.02 | | | | 4.17 | | | | | | | | 1.64 | | | | 1.87 | 1.52 | | | | | |
| G022616_40 | | 4.11 | | | | 2.60 | | | | | | | | | | | | 1.88 | 0.63 | | | | | |
| G022616_45 | | 4.17 | | | | 3.12 | | | | | | | | | | | | | | | | | | |
| G022616_5 | | 4.26 | | | | 3.10 | | | | | | | | | | | | 2.34 | 1.64 | | | | | |
| G052516_16 | | 5.41 | | | | | | | | | | | | | | | | | | | | | | |
| G052516_17 | 1.62 | 5.46 | | | | 4.55 | | | | | | | | | | | | 2.96 | 2.11 | | | | | |
| G052516_18 | 1.31 | 4.04 | | | | 3.05 | | | | | | | | | | | 2.14 | 1.68 | 1.89 | | | | | |
| G052516_24 | 1.58 | 4.73 | 1.35 | | | 3.52 | 1.34 | | | | | | | | | | | 0.56 | 2.81 | | | 1.08 | | |
| G052516_26 | | 3.57 | | | | 3.93 | | | | | | | | | | | | 2.92 | 2.56 | | | 0.45 | | |
| G052516_31 | | 4.54 | | | | 3.10 | | | | | | | | | | | | 1.57 | 2.40 | | | 0.58 | | |
| G052516_43 | | 4.19 | | | | | | | | | | | | | | | | | 1.35 | | | 0.24 | | |
| G052516_7 | | 5.03 | | | | 3.23 | | | | | | | | | | | | | 1.86 | | | 0.24 | | |
| G042616_19 | | 4.58 | | | | 3.87 | | | | | | | | | | | | 1.89 | 2.39 | | | 0.50 | | |
| G042616_2 | 2.25 | 5.59 | | | | 4.91 | | | | | | | | | | | | 2.10 | 2.64 | | | 0.87 | | |
| G042616_28 | | 3.87 | 1.51 | | | 2.33 | | | | | | | | | | | | 4.89 | 1.49 | | | | | |
| G042616_34 | | 4.14 | | | | 4.18 | | | | | | | | | | | | 2.60 | 1.89 | | | | | |
| G042616_4 | 1.58 | 5.09 | | | | 3.40 | | | | | | | | | | | | 4.28 | 2.41 | | | 0.23 | | |
| G042616_40 | 1.30 | 4.02 | | | | 4.66 | | | | | | | | | 2.58 | | | 2.68 | 1.95 | | | 0.55 | | |
| G042616_45 | | | | | | | | | | | | | | | | | | | | | | | | |
| G042616_8 | | 2.41 | | | | | | | | | | | | | | | | | | | | | | |
| G052316_10 | | 3.91 | | | | | | | | | | | | | | | | | 0.61 | | | | | |
| G052316_18 | | 3.72 | | | | 6.01 | | | | | | | | | | | | 3.17 | 1.68 | | | | | |
| G052316_19 | | 3.94 | | | | 3.23 | | | | | | | | | | | | 2.10 | 1.45 | | 0.94 | | | |
| G052316_24 | | 4.22 | | | | 2.54 | | | | | | | | | | | | 1.99 | 2.17 | | | 0.29 | | |
| G052316_25 | | | | | | 3.46 | | | | | | | | | | | | 2.26 | 1.38 | | 4.65 | | | |
| G052316_5 | | 4.33 | | | | 3.54 | | | | | | | | | | | | 2.39 | 1.86 | | | | | |
| G052316_7 | | 4.38 | | | | | | | | | | | | | | | | | 1.71 | | | | | |
| G052316_9 | | 4.20 | | | | 1.81 | | | | | | | | | | | | | 1.36 | | | | | |

Fig. 1, partial table, Satoshi Ishii 2017
(The units for the PCR method are log gene copies/ul DNA. Conversion to log gene copies/gram feces involves adding "2" to the value in the table.)

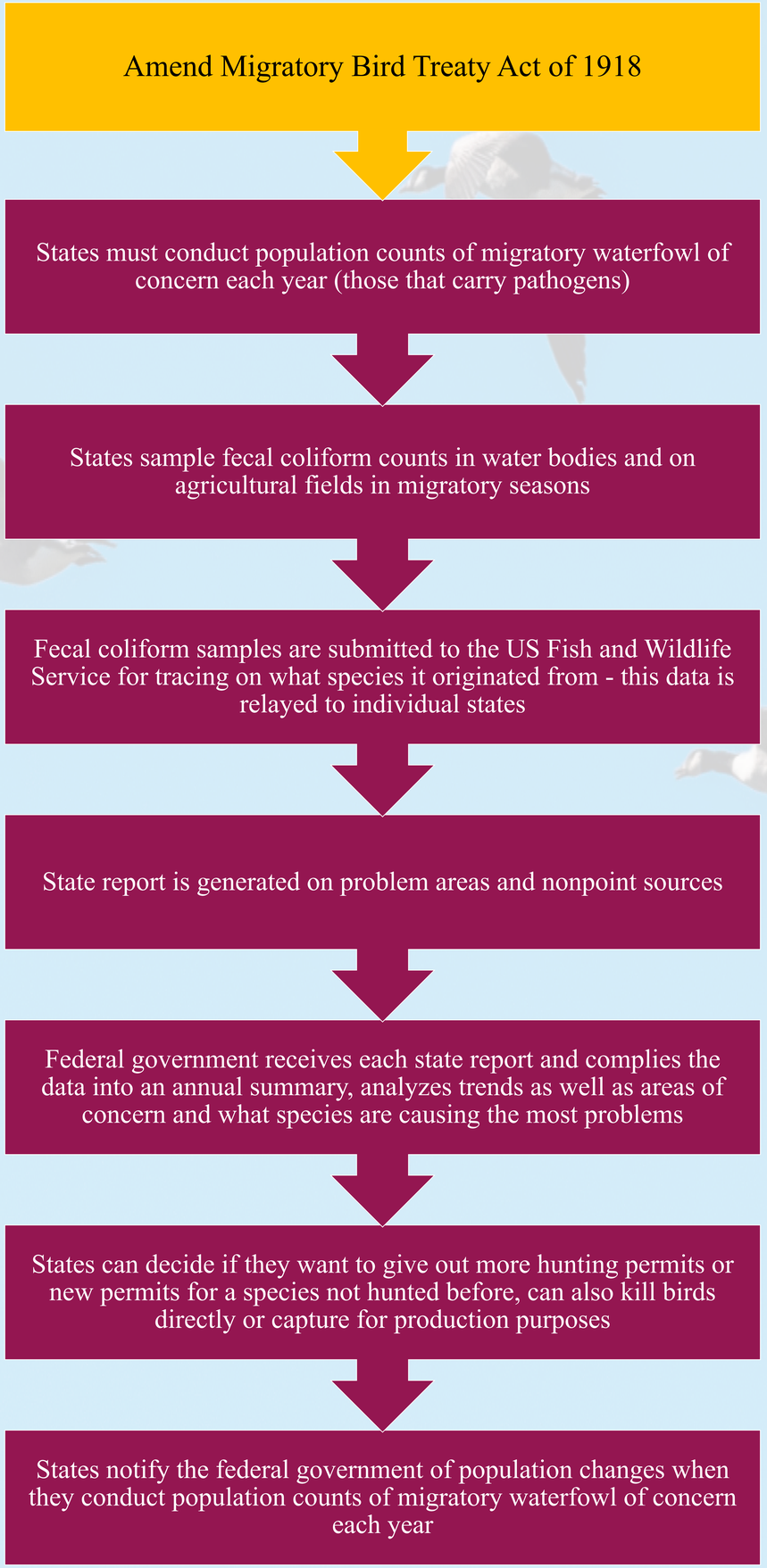


Fig. 2, list of federal and state actions, Hannah Ebersole 2017

## Materials and Methods

The quantitative number of pathogens found in water bodies via migratory waterfowl fecal matter was examined, and preliminary study of waste was completed in order to conclude that migratory waterfowl were posing a threat to human health (Ricke, Zhang and Ishii, unpublished data). Analysis was conducted of existing legislation and policies for migratory waterfowl, and international treaty data was compiled. Evaluation of legislation from international, federal, and state levels also occured.

## Results

- Amend the *Migratory Bird Treaty Act of 1918,* which encompasses Canada, the United States, and Mexico.
- Repeal all laws inconsistent with provisions of this amendment. Both Canada and Mexico will need to be privy to all decisions regarding migratory waterfowl.
- The *Endangered Species Act* in connection with *CITES* will not be privy to this amendment. Migratory waterfowl listed under the *Endangered Species Act* are **not** to be limited in population under any circumstances.
- The *Lacey Act of 1981*, *Weeks-McLean Law*, the *Fish and Wildlife Conservation Act*, the *Wild Bird Conservation Act*, and the *Waterfowl Depredations Prevention Act* are all subject to the amendment for certain waterfowl species causing degradation, and of these laws: those that are inconsistent with the new amendment's provisions are to be repealed.
- Individual state policy and federal policy is the last step in the capability to control migratory bird populations [Fig. 2].

## Discussion

The most significant result of this research is the layout of the state and federal policy for migratory waterfowl population control. While the amendments to the *Migratory Bird Treaty Act of 1918* reverse current legislation, the new state and federal policy serves to solve the problem of migratory waterfowl impacting human health, and provide a long-term policy solution. The goal of this legislation is not to decimate migratory waterfowl populations but rather to control and protect both the birds themselves as well as human health and food safety.

While these results might not be completely applicable, it remains a protection and research strategy for understanding the complex pathways of migratory birds. Further research into the complex food webs of migratory waterfowl, the impact permitting has on wildlife species, and the detailed fecal coliform samples could be attempted.

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